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PENNSYLVANIAN FORAMINIFERA FROM MONGOLIA[1]

BY J. J. GALLOWAY[2] AND L. ERSKINE SPOCK[3]

PART I

FIELD RELATIONS

BY L. ERSKINE SPOCK

INTRODUCTION

The Foraminifera described in the main part of this paper were obtained from a single specimen of limestone collected from a ledge outcropping on the south side of the Tairum Nor Basin in the eastern-central part of Inner Mongolia about 64 miles in a southeasterly direction from Iren Dabasu. Its approximate position is 43° 20′ N. and 113° 9′ E. (See Fig. 1.) The topography of the immediate vicinity can be seen on Sheet 21 of the topographic maps shortly to be published by the American Museum of Natural History. The material was collected by the writer on a reconnaissance trip east of the Kalgan-Urga trail in 1928, but it was not known to contain fossils until later. On his return from the Expedition of 1930, Père Teilhard de Chardin[4] reported the presence of Paleozoic Marine fossils from the same general region. This discovery led to a microscopic study of the pre-Cretaceous limestones of eastern and central Inner Mongolia and the subsequent finding of fragmentary remains of Foraminifera in the limestone of Tairum Nor. Additional thin sections revealed better-preserved material.

The limestone is compact and hard. In color it is brownish gray, intricately traversed by irregular veins of white crystalline calcite. These veins cut the rock in every direction. Only the denser portions have yielded fossils, most of it being too coarse and recrystallized.

ANCIENT LIMESTONES OF CENTRAL INNER MONGOLIA

Many outcrops of pre-Cretaceous limestone have been found in the vicinity of Tairum Nor, and adjacent parts of the Gobi. Wherever the contacts, with other rocks, are visible, they appear to be conformably enclosed between steeply dipping slates or graywackes. In general these

[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 116.

[2] Indiana University, Bloomington, Indiana.

[3] New York University; Geologist Central Asiatic Expeditions, 1928.

[4] Oral communication.

limestones are badly fractured, and in all but a few exceptional cases they are so thoroughly recrystallized that any fossils that may have existed originally are likely to have been destroyed.

The relation of this particular limestone to other rocks in the vicinity is not known, but similar limestones have been found at two[1] and probably at three places in alignment with this one, along the regional strike of the ancient rocks of the desert floor. Since these rocks show strong similarities in lithology and structural habit, it seems reasonable to assume that the Foraminifera-bearing limestone is a member

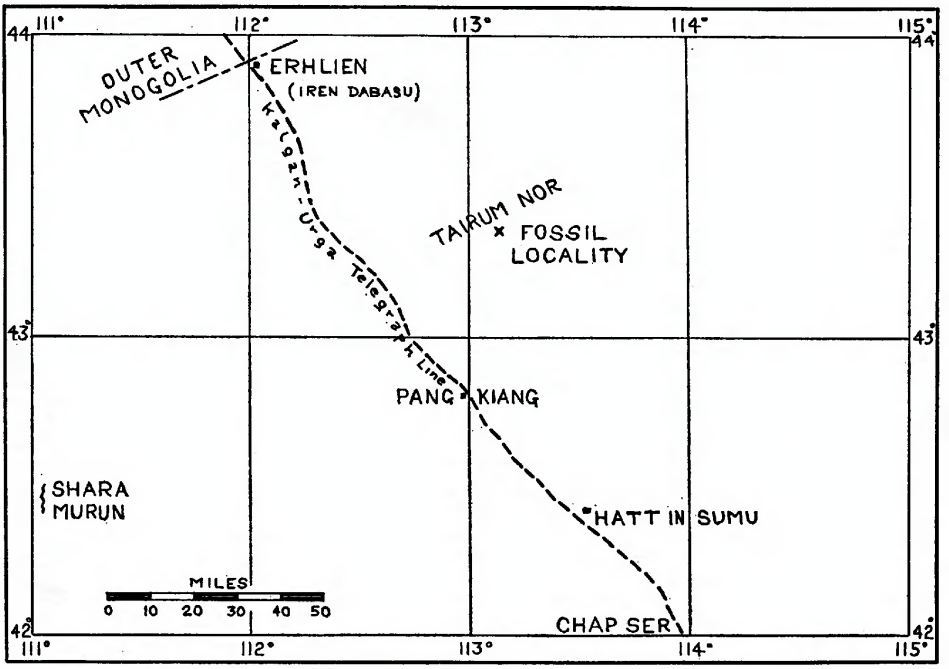

Fig. 1. Sketch map of a part of Inner Mongolia showing the position of the outcrop of limestone from which the Foraminifera were obtained.

of the slate-graywacke-limestone series which forms a large structural unit in this part of the desert. No fossils have been found in the limestones which lie along the line of strike, but their relation to the enclosing rocks can be seen. Here, as in many parts of Mongolia, the older rocks are buried below a thick cover of the "later" sediments. Exposures of pre-Cretaceous rocks are limited to basins excavated by the wind, and to hills which project up through the sediments. The rocks of the Tairum Nor region are further obscured by playa deposits and drifting sands.

[1]Teilhard de Chardin, P. 1930. Oral communication.

Paleozoic Limestones of Western Mongolia

In 1922, the first field season of the Central Asiatic Expeditions in Mongolia, Paleozoic strata were identified at several localities west of the Kalgan-Urga trail. Two of these are important: the Sair Usu formation,[1] of Mississippian (Dinantian) age, and the Permian beds at Jisu Honguer. Marine fossils have been collected from both formations, and those of Jisu Honguer[2] have already been described.

The Foraminifera described by Dr. Galloway in the following pages of this paper are of particular interest in that they establish the existence of marine rocks of Pennsylvanian age in the Gobi, and thereby add a new chapter to the Paleozoic history. Furthermore, they are the first Foraminifera collected for the American Museum by the Central Asiatic Expeditions in Mongolia.

Part II
DESCRIPTIONS OF FORAMINIFERA
By J. J. Galloway

Introduction

The rock is a gray, rather pure, hard limestone, made up of Foraminifera, Ostracoda, *Productus* spines, sponge spicules and finely comminuted fossil debris, embedded in a fine-grained, irregular, impure, calcareous groundmass. The limestone has been considerably dissolved away, making irregular cavities which have been filled with pure, coarsely crystalline calcite. It has also been much fractured, including the filled solution cavities, and the fractures have been filled with clear, coarsely crystalline calcite. There are embedded in the fossiliferous groundmass some small pebbles of very fine-grained, massive limestone, without fossils, and some rounded grains of calcite.

The fossils are well preserved, but cannot be freed from the matrix and may be studied only in thin sections.

The following Foraminifera have been identified:

Endothyra sp.
Bradyina nautiliformis Möller
Globivalvulina cf. *bulloides* Brady
Tetrataxis conica. Ehrenberg
Climacammina, n. sp.
Schubertella lata Lee and Chen

[1]Berkey, C. P., and Morris, F. K. 'The Geology of Mongolia,' Nat. Hist. Central Asia, II, pp. 170–173 and 406.
[2]Grabau, A. W. 'The Permian of Mongolia,' Nat. Hist. Central Asia, IV.

Age of the Rock

The rock is middle Pennsylvanian, upper Moscovian in age, and very close to the horizon of the Huanglung limestone of the Lungtan area of east central China.[1] It may also be correlated with the Marmaton group of Kansas, and the Strawn group of Texas. Most of the species occur in the upper Moscovian of China, and several of them in the same horizon in Russia and North America. None of the species occurs as high as the Permian.

Description of Species

Endothyra sp.

Figure 2 (1 and 2)

cf. *Endothyra bowmani* Lee and Chen, 1930, Mem. Nat. Res. Inst. Geol., No. 9, Nov., Pl. v, fig. 14. (Moscovian, Huanglung limestone, China.)

Test minute, 0.3 to 0.6 mm. in greatest diameter, with about ten chambers in the last whorl; the plane of coiling swings through 30° to 90° from the early stage to the adult; wall thin, 0.015 to 0.025 mm., calcareous, finely granular or transversely fibrous, not composed of agglutinated, foreign particles. Abundant.

There are two species, a larger and a smaller one. Neither is probably the same as *E. bowmani* Phillips, from the Lower Carboniferous of England, which is planispiral throughout, according to the original figure. They are more similar to several described species from the Pennsylvanian of Kansas, Oklahoma and Texas, and the form figured by Lee and Chen. The species cannot be identified from thin sections, which do not show the aperture.

Bradyina nautiliformis Möller

Figure 2 (3 and 4)

Bradyina nautiliformis Möller, 1878, Mém. Acad. Sci. St. Pétersbourg, Ser. 7, Vol. 25, No. 9, p. 93, Pl. iii, fig. 4; Pl. x, fig. 3. (Moscovian, Russia.) Lee, J. S., Chen, S., and Chu, S., 1930, Mem. Nat. Res. Inst. Geol., No. 9, Nov., p. 104, Pl. v, figs. 5–9 (Moscovian, Huanglung limestone, China.)

Test of medium size, 1.6 mm. in greatest diameter, 1 mm. in shorter diameter, nautiloid, planispirally coiled in the adult, the plane of coiling swinging through about 30° from the young to the adult stage; six chambers in the last whorl; a thin, secondary septum extends inward from the posterior part of the chamber and joins with the preceding septum; wall up to 0.12 mm. thick, calcareous, not arenaceous, consisting of a thin tectum and thick keriotheca, in which are occasional large, round grains of calcite; aperture not observed. Common.

This form seems to be identical in all respects with the Moscovian ones from Russia and China.

[1] Lee, J. S., Chen, S., and Chu, S. 1930. Mem. Nat. Res. Inst. Geol., No. 9, November, p. 85.

Globivalvulina cf. **bulloides** Brady

Figure 2 (5)

Valvulina bulloides Brady, 1876, Pal. Soc. Mono., p. 89, Pl. iv, figs. 12–15. (Upper Pennsylvanian, Iowa.)

Globivalvulina bulloides Galloway and Ryniker, 1930, Oklahoma Geol. Surv., Circ. No. 21, p. 16, Pl. iii, fig. 1. (Lower Pennsylvanian, Oklahoma.)

Test small, 0.3 mm. in greatest diameter; chambers rapidly enlarging, the last nearly as large as all preceding; wall thin, about 0.013 mm., calcareous, finely granular. Rare.

Tetrataxis conica Ehrenberg

Figure 2 (6)

Tetrataxis conica Ehrenberg, 1843, Bericht. k. preuss. Ak. Wiss. Berlin, p. 106; Mikrogeologie, 1854, Pl. xxxvii, Pt. 11, fig. 12. (Moscovian, Russia.) Möller, 1879, Mém. Acad. Imp. Sci. St. Pétersbourg, Ser. 7, No. 5, p. 71, Pl. ii, fig. 3; Pl. vii, figs. 1, 2. (Moscovian, Russia.) Lee, J. S., Chen, S., and Chu, S., 1930, Mem. Nat. Res. Inst. Geol., No. 9, Nov., p. 90, Pl. iii, fig. 1. (Moscovian, Huanglung limestone, China.)

Test small, 0.6 mm. high and 0.82 mm. wide at the base, with rounded apex; chambers inflated downward; wall thick, consisting of a thin, dark, upper layer and a thicker, transparent, fibrous lower layer. The section probably does not cut through the apex and the axis of the test. This form is very similar to those found in the Moscovian of Russia and China.

Climacammina, n. sp.

Figure 2 (7)

cf. *Cribrostomum eximium* Lee and Chen, 1930, Mem. Nat. Res. Inst. Geol., No. 9, Nov., p. 100, Pl. iv, fig. 9. (Moscovian, Huanglung limestone, China.)

Test large, conical, slender, 2.6 mm. long, 1 mm. wide at the apertural end, composed of eight or nine pairs of chambers arranged biserially, followed by two or three uniserial chambers; wall thick, dark, with thin, transparent streaks parallel to the wall; aperture cribarate in the uniserial chambers.

This form seems to be identical with the one described by Lee and Chen. It is not a *Cribrostomum*, however, which is biserial throughout. Neither is it *Textularia eximia* Eichwald, which is biserial, with a single, slit-like aperture.

Schubertella lata Lee and Chen

Figure 2 (8)

Schubertella lata Lee and Chen, 1930, Mem. Nat. Res. Inst. Geol., No. 9, Nov., p. 111, Pl. vi, figs. 9–11. (Moscovian, Huanglung limestone, China.)

Test minute, ovoid, 0.6 mm. in axial diameter and 0.4 mm. in median diameter; proloculum 0.08 mm. in diameter; nucleoconch endothyroid, at right angles to the adult whorls, consisting of one whorl of eight chambers; wall thin, 0.015 mm., consisting of a single, very finely granular, but not arenaceous, layer; septa not fluted; chomata scarcely discernible.

This is the only species of the Fusulinidae seen in the limestone. It seems to be identical with the Moscovian form from China.

Spines of Productus

Figure 2 (9)

The limestone contains large numbers of round, elliptical and tubular structures, varying in diameter from 0.08 to 0.3 mm., which originally were hollow. The walls are either finely granular or transversely fibrous and alveolar. These structures are probably not Foraminifera, but the spines of the brachiopod genus *Productus*.

Fig. 2. Microscopic section of Foraminifera from Tairum Nor, Mongolia.

(1) *Endothyra* sp. × 70. Transverse section, showing 30° swing in the plane of coiling.

(2) *Endothyra* sp. × 70. Median section of a smaller species, showing 90° swing in the plane of coiling.

(3, 4) *Bradyina nautiliformis* Möller. × 25. 3. Median section, showing secondary septa and alveolar wall structure. 4. Transverse section, showing the proloculum, and swing in the plane of coiling.

(5) *Globivalvulina* cf. *bulloides* Brady. × 70. Section parallel to the base.

(6) *Tetrataxis conica* Ehrenberg. × 55. Oblique vertical section.

(7) *Climacammina*, n. sp. × 25. Longitudinal section parallel to the axis, showing uniserial later chambers, with many tubular apertures.

(8) *Schubertella lata* Lee and Chen. × 70. Section oblique to the axis, showing proloculum and endothyroid nucleoconch.

(9) *Productus* spines. × 70. Cross sections. The three lower ones are of average size. The upper one has thick, alveolar walls, and may be a foraminifer.

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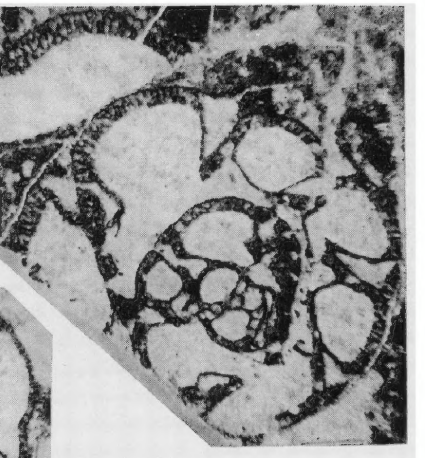

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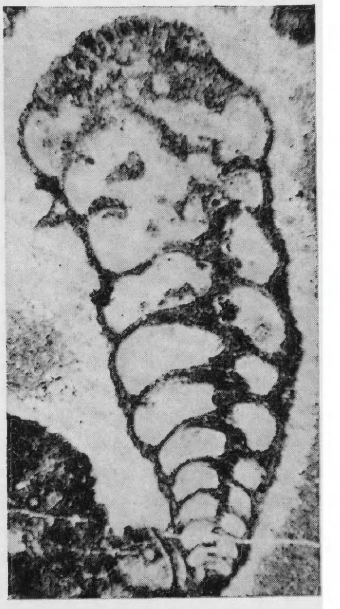

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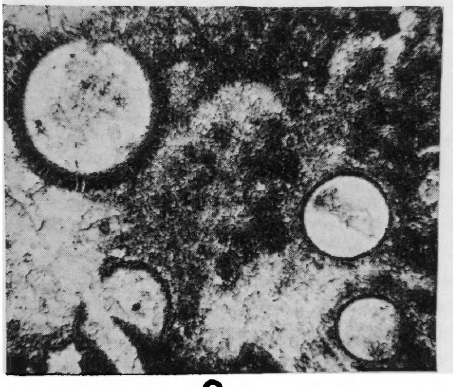

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